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Preliminary Evaluation of a Portable Handheld Combined Gamma and Neutron Directional Isotopic Identifying Detector

Robert Bruce Hayes
Remote Sensing Laboratory: MS RSL-47, PO Box 98521, Las Vegas, NV, 89193, USA

Purpose: To simulate the performance of a portable dual gamma and neutron identification detector array with dual directional detection capability for preliminary algorithm evaluation.
Experimental procedures: Monte Carlo N-Particle (MCNP) analysis on a compact array of borated polyvinyl toluene light pipes and photomultiplier tubes, standard spectral histogramming, and directional detection capability simulations.
Results: Results demonstrate that the detector system is fully capable of correcting for background variations when identifying common gamma and neutron sources while simultaneously providing source location direction estimates. Familiar anthropogenic isotopes are readily identified such as Am-241, Cs-137, Cf-252 and Co-60. Directional resolution is estimated to be within approximately 15 degrees. Specifically, all features expected for the array have been demonstrated to be credible through MCNP analysis.
Conclusions: Use of this handheld dual neutron and gamma spectrometer has the promise of widespread applicability. By ultimately correlating MCNP results with empirical measurements, substantial confidence can be placed on predicting detector response to sufficiently similar spectral sources under alternate experimental configurations. Use of the detector has substantial promise for operational health physics applications.

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